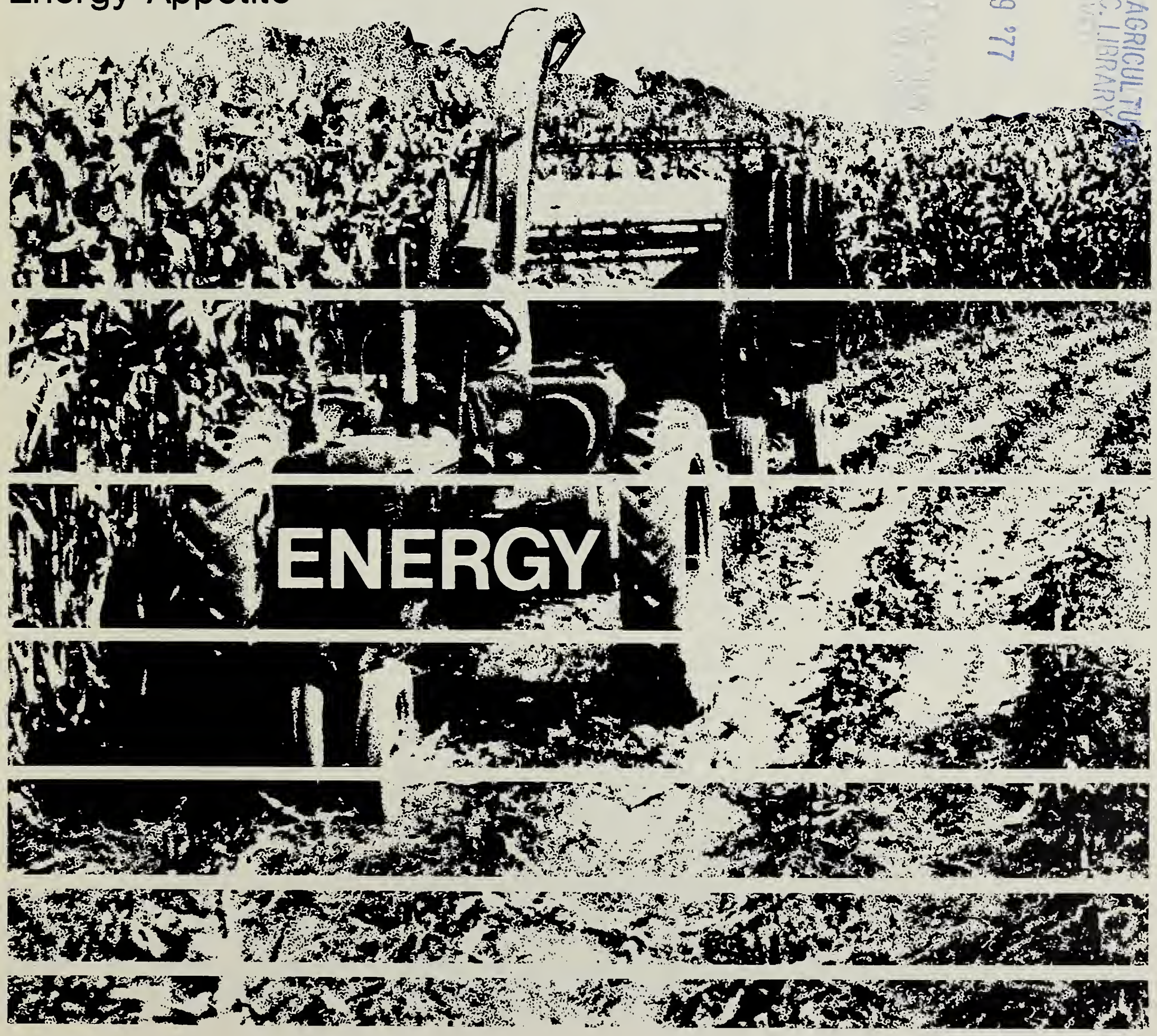
FARM INDEX

U.S. Department of Agriculture
September 1977

Trimming Agriculture's Energy Appetite



Outlook

It looks like consumers will make out better than farmers this year. Advances in retail food prices should taper off for the rest of 1978. Same goes for prices to farmers, except that their prices will be sinking faster than grocery prices.

Despite foul weather early in the season, bumper harvests are in store for many U.S. crops. Soybeans will surely shatter all records . . . corn may narrowly miss an alltime high based on the August forecast . . . and wheat has already gone down as the third largest crop in history. The big harvests, coupled with weakened export demand, spell financial woes for many producers.

Tumbling crop receipts. Bumper harvests aside, cash receipts of crop farmers in second half 1977 are apt to drop several billions from the 1976 period, mainly due to sagging prices. For all of 1977, crop prices might average a tenth lower. Saving grace is larger livestock receipts, which should bring total agricultural receipts in second-half 1977 near the $92 billion of last year (seasonally adjusted annual rate).

The steady creep in production expenses could drag down net income for the farm sector this year. However, if Congress gives the green light to the farm bill as now written—and the President signs it into law—there's a chance that total net income will approach last year's level, thanks to subsidies farmers will receive.

Another rough year for wheat prices. U.S. wheat stocks are mounting for the fourth year in a row. Carryover next May 31 could be the biggest since 1962. Once the current harvest is squared away, prices should strengthen seasonally as a result of heavy loan placements and the 3-year reserve program. Nevertheless, it would take a kicker from exports to push prices up more than seasonally. It could come from a shortfall in the world grain crop, but that's highly unlikely. World wheat crop in 1977 will be close to last year's record, and supplies could be the largest in history.

Similar story for soybeans. The 1977 U.S. crop promises to be the biggest ever, perhaps a fourth more than last year. Total use might go up a notch—hardly enough to prevent a stock buildup. Carryover on Sept. 1, 1977, could be double the current level.

Prices received by farmers for the coming season, based on current crop prospects, could range between $5 and $6 a bushel. That's off sharply from the $7.32 estimated for the 1977 season but still above the support price.

Retail food price forecasts to stick. Economists are holding to earlier predictions that grocery store prices will rise 6 percent for all of 1977. Adding away-from-home eating, however, the overall average might rise a shade more.

Little, if any, of that increase will revert to farmers, rather, to the marketing chain. Also, higher prices for imported foods will account for much of the bulge: Over half of this year's jump in retail food prices is charged off to imports.

N.B. beef eaters. Beef production seems to be leveling for now, and could show declines in 1978. So, expect more price hikes next year at the retail counter. Smaller beef supplies reflect the rapid rate of herd liquidation. The selloff will persist into 1978.

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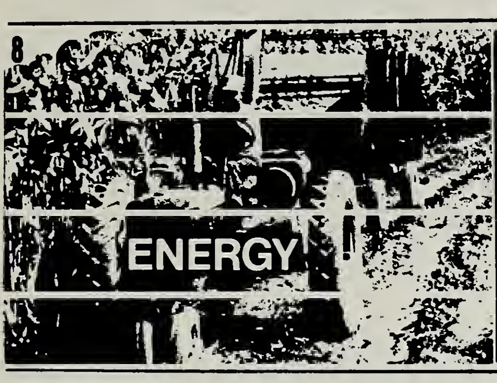

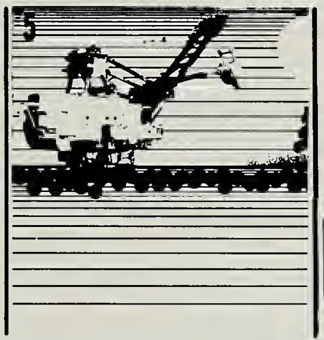

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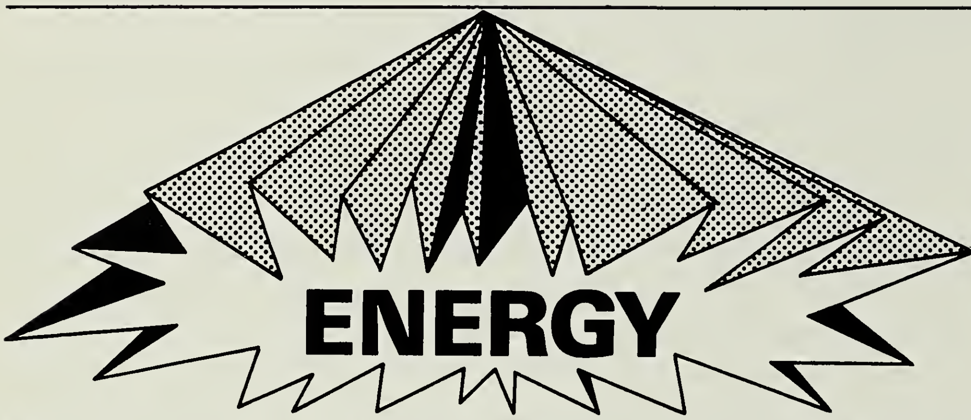
Energy Outlook



Editor's Note: The U.S. economy faces serious energy problems, and our agricultural system—with a hearty appetite for petroleum-based oils and natural gas—is extremely vulnerable. *Farm Index* takes a look at the energy situation in this special issue.

The remarkable accomplishments of the U.S. food and fiber system in this century—and all other sectors of the economy, for that matter—owe much to an abundance of fossil fuels and electricity.

In the past, national policies were directed towards ensuring bountiful and low-cost energy as a means of providing the goods and services that have enhanced our standard of living.

As a result, energy consumption in the U.S. has more than doubled since 1950, and if unabated, could double again by the year 2000.

Just prior to the 1973 Arab oil embargo, one-third of our oil supplies were imported. Today, despite efforts to curtail our dependence, the figure has risen to one-half. And unless we become more efficient in its use, an even greater percentage of the oil we use could come from foreign producers by the turn of the century.

Natural gas shortages. Last winter, widespread natural gas shortages put nearly 2 million people out of work. Although a winter of similar severity would have put stress on energy supply and distribution in any year, the winter of 1977 emphasized imminent difficulties forthcoming in the natural gas supply picture.

Oil and natural gas comprise over three-fourths of America's energy consumption, while representing less than a tenth of the domestic resource base.

U.S. oil production has been steadily declining during recent years. Oil tapped from the Outer Continental Shelf and Alaska will reverse this trend for a few years. Nonetheless, according to Government projections, the prospect beyond 1985 is for a resumption of the downward course.

Natural gas production peaked in the early 1970's and has dropped about 15 percent since. Production may decline another 30 percent in the next decade.

Depleted reserves. Domestic oil and natural gas reserves will largely be depleted 40 years from now, giving the U.S. little time to shift to more plentiful forms of energy, such as electricity generated from coal and nuclear power.

The "exotic" forms of energy—solar, geothermal, and synthetic fuels—won't supply more than 1 percent of U.S. energy needs by 1990. Nuclear fusion won't make any contributions until after the turn of the century.

Here's where agriculture enters the picture.

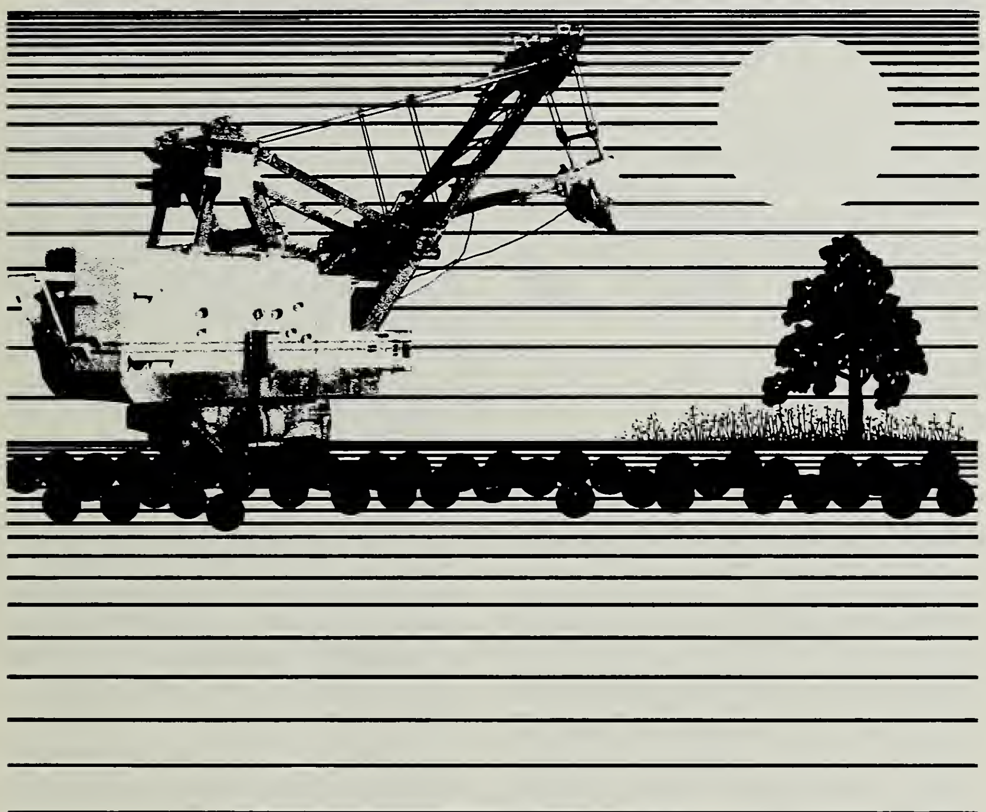
About half of the energy consumed in the food, fiber, and forest products system is petroleum based—primarily diesel fuel and gasoline—and another third is natural gas. The strong tie to these two "problem" fuels illustrates the food system's vulnerability to energy problems.

Energy and agricultural production. Unlike other industries, agricultural production is based on biological functions highly dependent upon seasonal changes: Temporary interruptions in energy supply at critical times could cripple production for an entire year.

To ensure the availability of energy, the food and fiber system is trying to conserve through sound energy management programs. While such practices are optional right now, they may soon be written into law.

[Based on the manuscript, "Energy and the U.S. Food System: Situation and Outlook," by Patricia Devlin, Edward Rall, Thomas Van Arsdall, and Earle Gavett, National Economic Analysis Division.]

Coal Vs. the Environment: A Great Plains Dilemma



The Northern Great Plains holds what could be an answer to America's energy shortages: coal.

Just below the land surface, in rich, thick seams, lie vast quantities of easily mineable coal that can be used to power electric generators, heat homes, and fuel factories; that can be turned into synthetic oil and gas; and some of it can be used in making steel, chemicals, or many other products.

In fact, the area accounts for more than a third of our Nation's known coal reserves, nearly half of which can be taken without dangerous and expensive deep mining. In other words, the coal is surface mineable, or strippable. Almost half of it is low enough in sulfur content so that, under current pollution control laws, stack gas "scrubbers" are not needed to cleanse harmful sulfur gases from the chimneys of coal-burning power plants. Thus, pollution control costs can be slashed.

Bounteous energy. The area's coal reserves add up to a relatively cheap, potential energy source. But there are other factors to consider.

For example, the huge increase in the region's mining in the last quarter century—5 million tons was mined there in 1960, 68 million last year—may have several profound effects on the quality of life in the Northern Great Plains. And with the possibility of further expansion, the question: "How can more coal be mined, while environmenal damage is minimized?", becomes even more pressing.

Some of the impacts of coal mining have already surfaced:

People. Until about 1970-74, people were leaving the Northern Great Plains. Those who remained were generally farmers.

The situation has changed. Farming accounted for only 20 percent of the region's jobs in 1970, and the people, for the first time in years, began moving in, not out.

These changes have been attributed in large part to coal mining and related industry, such as contract construction. In essence, industry has brought jobs, which have meant more money.

Both farm and nonfarm earnings in 1970-74 for male workers were greater on the average than in any other U.S. nonmetropolitan area. Women there, though, earned less on the average than those in other parts of the country.

A certain sameness. But some things haven't changed much. The region is still largely nonmetropolitan, for example, with 34 percent of its 1976 population living in towns smaller than 10,000. Another 36 percent lived in open country.

Indians make up roughly 3 percent of the region's population, and about 9 percent of the strippable coal reserves are under two of the region's six Indian reservations. Thus, the potential for wealth for those few Indians occupying coal

land is enormous. But various sociological problems could also develop, not the least of them being major economic disparities among and within Indian tribes.

Land. Most of the land in the Northern Great Plains hangs to its usefulness by thin ecological threads. The fragile ecosystem—the relationships among soil conditions, rainfall, wind, and biology—can be easily disrupted, perhaps to the lasting damage of all who live with the land.

During 1930-71, only one-twentieth of 1 percent of the region's land was disturbed by surface mining. But in all those years, less than half the surface-mined land was reclaimed. Unreclaimed land often lay in waste, with topsoil buried or eroded, and vegetation and animal life gone.

More recently, land reclamation has become a major concern of coal miners and public policymakers.

Although coal-bearing rocks are under about 30 percent of the land area, only 1 percent of the land is strip mineable.

Easily disrupted ecology. But, the fragile nature of the region's ecology makes that 1 percent important to the well-being of the entire region, considering that it takes 48-128 acres of land disturbed by mining and related operations to produce 1 million tons of coal.

Revegetating those acres in some areas is relatively easy: Replace the topsoil and plant. But in other areas it's more difficult.

The U.S. Forest Service has identified 146 distinct subareas in the Northern Great Plains, and ranked them according to revegetation potential. On the average, the land ranks "fair," but ironically, the areas of highest potential are also those that have little mineable coal. Existing mines are generally in "good" revegetation areas. It's likely that "poor" areas—largely untouched by mining now—will be more affected as coal mining spreads.

Water. To the farmers and ranchers in the Northern Great Plains, the question of water supply is especially crucial. Some areas have more water than needed—around parts of the Missouri River, for example—while other areas just get along, such as the western Dakotas. Thus, a conflict could develop between coal miners and processors, who need large quantities of water, and irrigators or livestock raisers.

The problem could become acute if the concept of "mine mouth" electric power plants is expanded. The idea is to locate electric generators—which boil water to drive turbines—as near as possible to the coal mines, cutting fuel transportation costs considerably. But electric power plants use huge amounts of water and could be in competition with other water users.

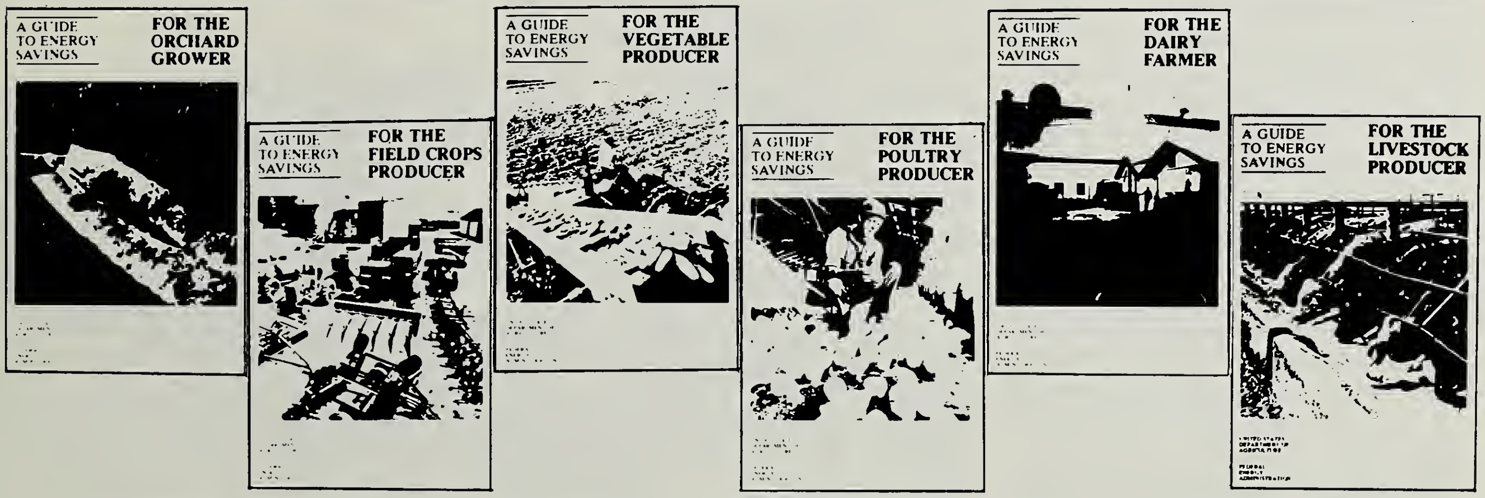
A way out. One solution is for the coal miners and others to transport water from where it's plentiful to where it's scarce. And that could be an expensive proposition, involving diverting rivers and building aqueducts and reservoirs.

Besides the costs involved, there's always the question of who controls the water. An agreement among States on the Yellowstone, for instance, gives any of those that signed the accord a veto over any plan to remove water from the Yellowstone Basin. And another veto could come from Indian reservations, which have rights over certain waters that flow through their lands in Montana.

If all the problems are surmounted, though, and coal mining in the Northern Great Plains goes forward, the region could become one of America's premier energy suppliers.

[Based on "Northern Great Plains Resources and Coal Development," Natural Resource Economics Division Working Paper No. 29, by NRED and the Economic Development Division.]

Saving Energy by the Book



Helping agriculture to manage energy effectively is the goal of a series of books, *A Guide to Energy Savings*, released by USDA.

The books were written by commodity and energy experts in the National Economic Analysis and Commodity Economics Divisions, with some help from the Federal Energy Administration.

Single copies of the books are available free—while the limited supply lasts—by writing to the Office of Communication, Publications Division, USDA, Washington, D.C. 20250. The six books cover different aspects of agriculture:

• *For the Orchard Grower.* Orchard crops in 1974 used nearly 97 trillion Btu's—5.4 percent of total energy expended in crop production. This book shows the farmer how to use energy more effectively through improved irrigation and fertilizer techniques, along with soil testing and other procedures.

• *For the Field Crops Producer.* Growers of field crops, perhaps more than some other farmers, feel the effects of recent rapid rises in fuel costs because field work uses large amounts of expensive fuel. This book shows how many farmers can chop fuel costs by 40 percent—down 4 gallons of diesel fuel an acre—through "minimum tillage." Substantial energy savings can result from less plowing and other cultivation, say the experts. Efficiency in fertilizer use, irrigation, grain drying, and other operations are also discussed.

• *For the Vegetable Producer.* Replacing human labor with machines in recent years has made vegetable production more and more energy intensive. Nearly all harvesting is done by machine today, and that means increased fuel costs. But the largest single cost is for the fertilizers. Fertilization takes over 43 percent of the energy used on vegetables. This book helps the farmer ease that use, while still achieving high crop output.

• *For the Poultry Producer.* Over 71 percent of the energy used in the poultry business goes into brooding, and big savings are available to the farmer who takes the right steps. Improved ventilation and waste removal practices can help reduce energy use by 20–50 percent.

• *For the Dairy Farmer.* Dairy farmers pay an average $35 a year per cow to produce milk. But, it's growing more expensive. Through proper energy management, a dairy farmer can reduce his energy consumption 10–20 percent per cow.

• *For the Livestock Producer.* Livestock production is a big energy user. Producers used about 133 trillion Btu's in 1974, with much of it going to fuel trucks, cars, and other vehicles used around the farm or to transport the livestock. Ten to twenty percent energy savings are available, through proper equipment maintenance and more efficient field operations.

[Based on the series, *A Guide to Energy Savings*, from USDA and the Federal Energy Administration.]

Trimming Agriculture's Energy Appetite

The complexity of the Nation's energy crisis is reflected in the struggle for energy conservation within the vast food and fiber system.

In a nutshell, the problem is to dim energy use without diminishing critical agricultural supplies.

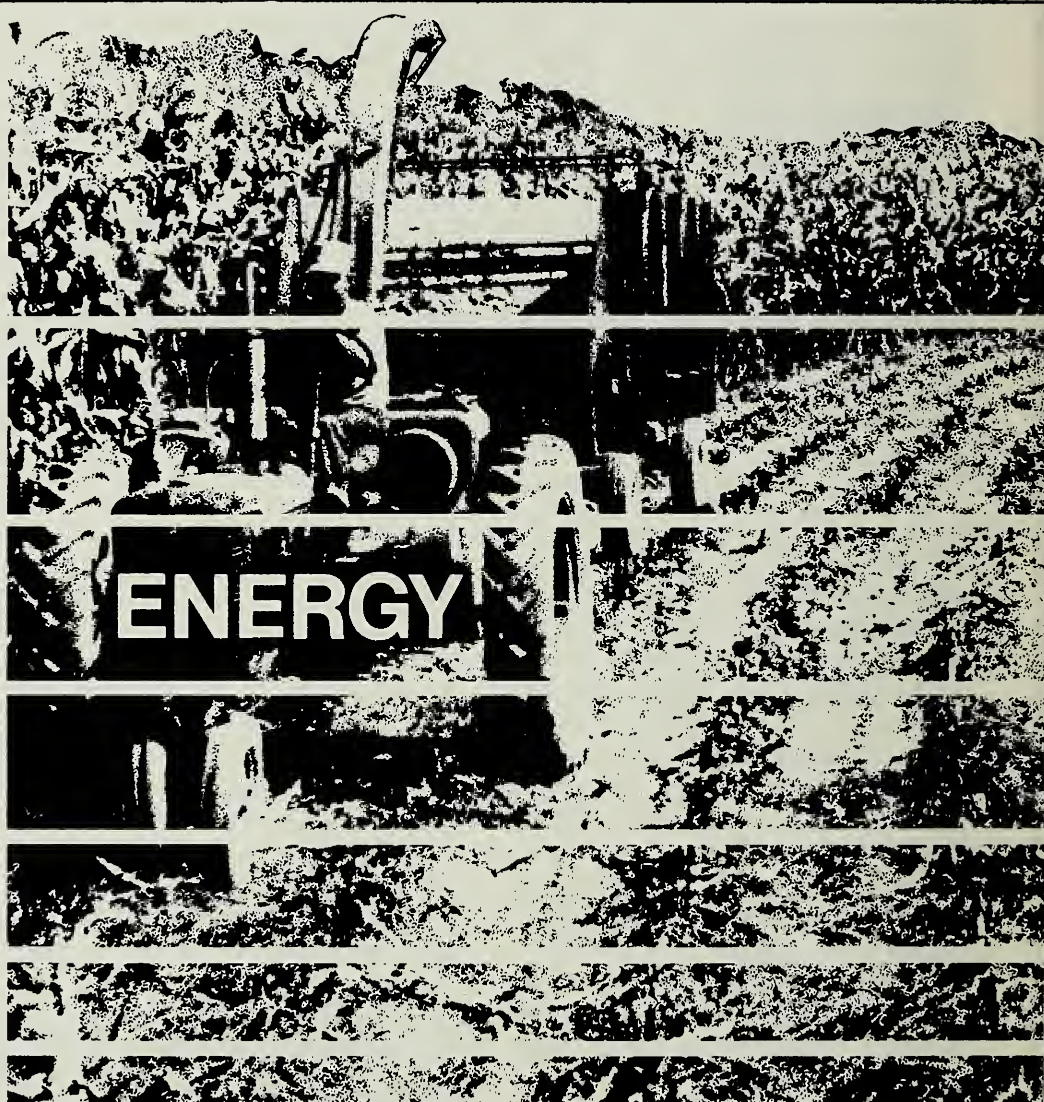
In 1974, 22 percent of the total energy used in the U.S. was related to the production, processing, marketing, and consumption of food, natural fibers, and forest products. The food system alone used 16.5 percent of the Nation's total energy consumption.

A breakdown of the energy used in the food system reveals that farming used 18 percent; processing, 29 percent; marketing, 8 percent; consumption preparation at home, 26 percent; consumption preparation away from home, 17 percent; and production of transportation equipment, 2 percent.

Technological advances. Much of that energy consumption stems from technological advances in the past half century that have required vast infusions of energy to:

- Reduce labor requirements through mechanization on the farm and convenience foods in the home.
- Increase food production while using less land through such methods as chemical fertilizers and pesticides.
- Reduce waste and produce the kinds of food in processing and marketing to suit consumer preferences.
- Lower the risk of crop failure or food spoilage.

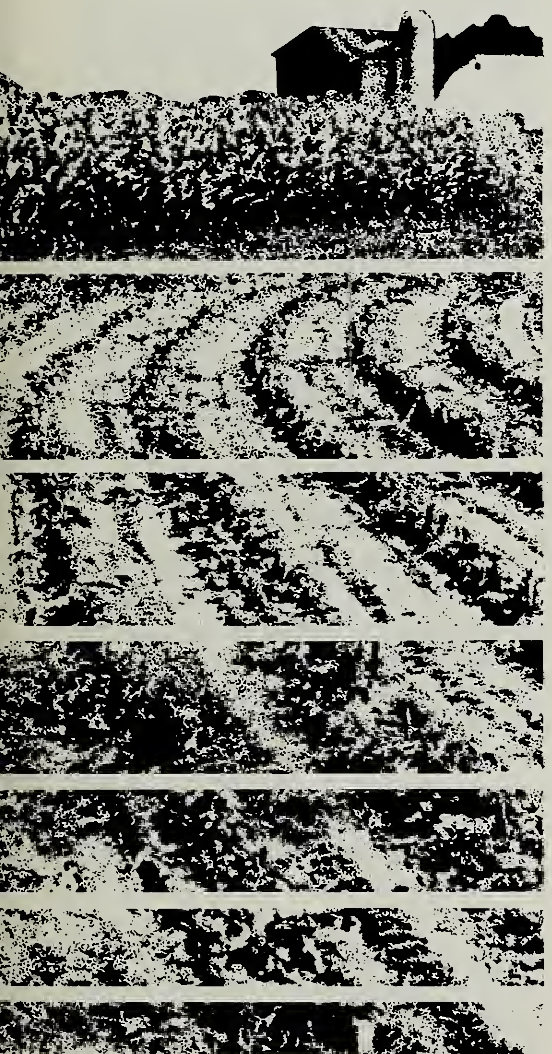
While technology has given the U.S. a wealth of agricultural products at relatively low prices, energy has become the system's life blood.



Each component of the system draws its energy requirements from the fossil fuel that best suits its particular needs.

What type of fuel? For example, food processors and petrochemical manufacturers rely heavily on clean-burning, controllable, relatively inexpensive natural gas, while mechanized equipment on the farm and throughout the transportation system uses significant amounts of gasoline and diesel fuel. Electricity is the dominant power form for food marketing and home preservation and preparation.

While it is possible to estimate the rate and type of energy consumption for each sector of the food system (production, processing, marketing,



and consumption) finding ways to conserve energy throughout the system is a more difficult task because of complications introduced by economic reality, technological practicality, human motivation, and value tradeoffs.

To assess energy uses and possibilities for conservation, each sector of the food system must be examined. Let's begin with energy consumption on the farm.

FOOD PRODUCTION

On the farm, 90 percent of production energy goes to grow, harvest, and cure crops. The rest is used in livestock production.

About a fourth of the energy used on crops goes into the production of corn—the Nation's largest crop. Along with wheat, cotton, and soybeans, corn is a member of the big four export crops. Together, the four commodities account for more than half of the total energy used for crops.

There are great variations in energy use among the different commodities. For instance, in 1974, it took only 1,700–1,900 Btu's of energy to produce a pound of corn, wheat, or soybeans, while cotton and tobacco required 24,000 and 29,000 Btu's per pound, respectively.

High energy users. The high energy input for cotton comes from irrigation and the heavy use of pesticides. Flue-cured tobacco's energy usage reflects intense cultivation and use of chemicals, prolonged heat requirements for drying and curing, as well as some inefficiency associated with small sizes of operations.

Even for similar commodities there are tremendous variations in the amount of energy used for its production because of differences in producing areas, cultural practices, production systems, management skill, and farm size.

For example, California processing tomatoes that were machine harvested used only 236 Btu's per pound in 1974. By contrast, fresh market winter tomatoes grown in Florida used seven times as many Btu's per pound and were picked by hand.

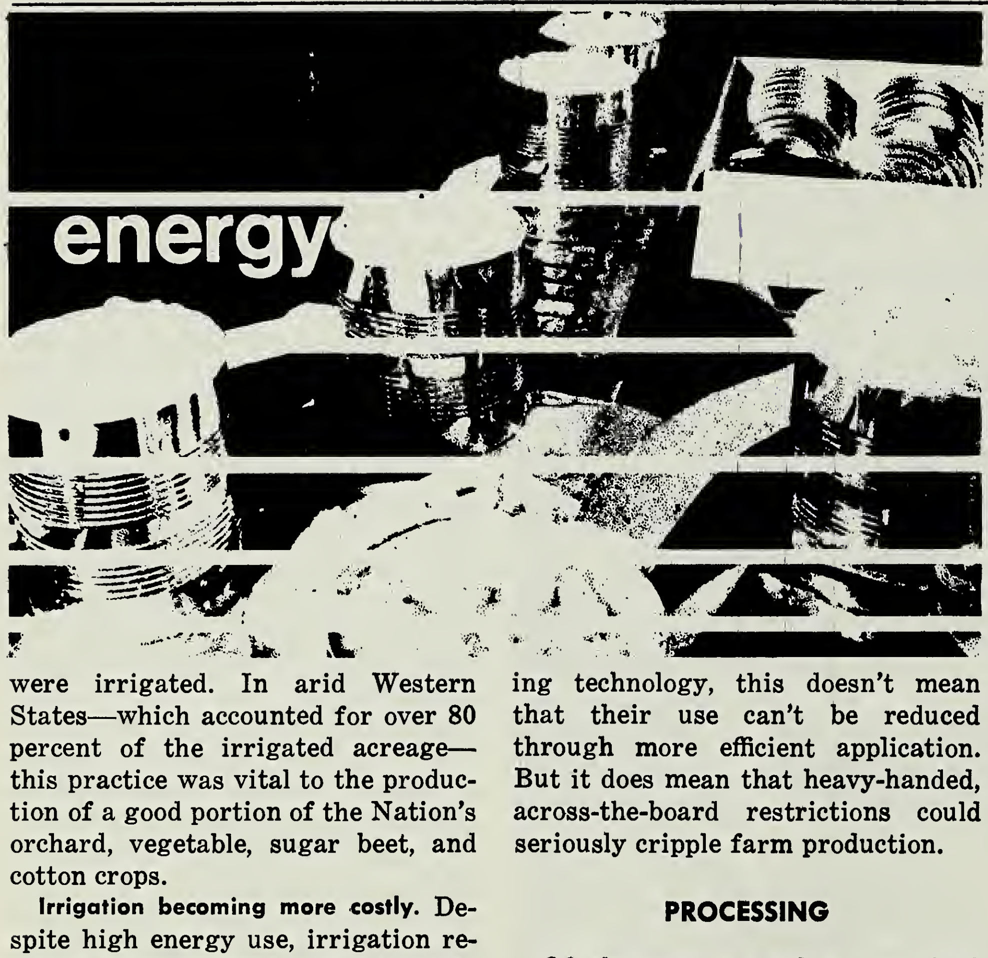
Feedlot vs. range cattle. Beef production is another good example. High quality beef finished in a feedlot on corn often takes eight times as much energy input as is contained in the retail beef product. On the other hand, range beef—without any supplemental finishing—requires only two times as much energy as is in the retail product.

Fertilizer consumes the largest single component of energy in agricultural production—31 percent in 1974—followed by irrigation, farm vehicles, preharvest field operations, harvest operations, grain and feed handling and drying, livestock care, and pesticides.

Natural gas guzzler. Nitrogen alone requires 490 billion cubic feet of natural gas a year—2 to 3 percent of the Nation's total demand for this energy source. About 40 percent of nitrogen production's natural gas requirement could technologically be replaced with other fuels, but this would result in substantial increases in the cost of producing nitrogen.

Farmers have increased nitrogen use because it pays off with higher yields. Initially, there is a large yield response as nitrogen is added to the soil; this eventually tapers off as other factors become limits to production. When additional nitrogen no longer pays for itself with increased yields, the farmers stop adding more fertilizer.

Although energy intensive, about 15 percent of the Nation's 331 million acres harvested during 1974



were irrigated. In arid Western States—which accounted for over 80 percent of the irrigated acreage—this practice was vital to the production of a good portion of the Nation's orchard, vegetable, sugar beet, and cotton crops.

Irrigation becoming more costly. Despite high energy use, irrigation remains economic to farmers because of publicly subsidized water for agriculture and low natural gas prices. However, rising energy prices and falling water tables are making irrigation more costly.

Irrigation may be energy intensive, but without it, the farmer's chances of harvesting a good crop hinge solely on capricious weather. In some cases, irrigation is a necessity; in others, it's a critical safety factor.

Although fertilizer and irrigation are crucial elements of modern farming technology, this doesn't mean that their use can't be reduced through more efficient application. But it does mean that heavy-handed, across-the-board restrictions could seriously cripple farm production.

PROCESSING

Of the energy used in our food system, processing takes the biggest share—29 percent in 1974, which amounted to 4.8 percent of the Nation's total.

As in the production sector, the amount and type of energy used in food processing varies greatly. For example, the energy required to process beet sugar ranges from 900 to 1,900 Btu's per pound of product, depending on the location of the plant. Plants in northern areas having severe winter climates generally require more energy than those in such States as California and Arizona.

Natural gas is the dominant energy source for all major types of processed foods. The food processing industry will have no economic incentive to convert to more plentiful alternative fuels until natural gas is priced enough above the heat unit value of other fuels to offset its desirable clean-burning and convenience characteristics.

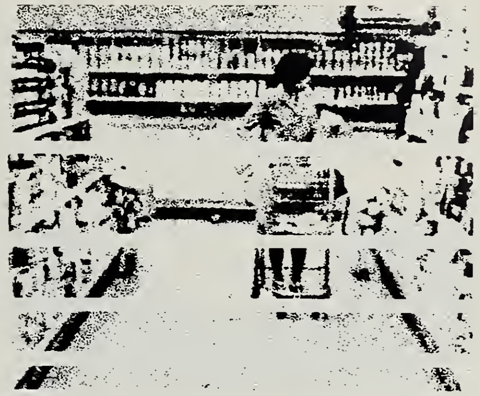
Even then, conversion would occur at the normal rate of capital replacement unless other incentives were introduced.

FOOD MARKETING

On a national average basis, electricity is the primary energy source of the food marketing sector, thanks to the heavy energy requirements of refrigeration, which accounts for about 60 percent of a retail food store's energy use. The need for refrigeration has increased as consumers have switched from canned produce to a larger variety and quantity of fresh and frozen foods.

Electricity usage is greatest in stores with both an on-premises bakery and delicatessen. Newer stores, which tend to offer one or both of these services, and larger stores also have high electricity requirements.

Energy reductions. Substantial reductions in energy use in supermarkets are unlikely to occur without changes in both the type of foods consumers prefer (more canned foods that need little or no refrigeration) and the range of services offered.



Heating energy can be significantly cut with heat reclaiming equipment—up to 42 percent—but, unfortunately, the energy required for heating is only a small portion of the total energy used. Real energy savings would have to come from refrigeration, which consumes more than half the food marketing energy.

But due to the small cost of energy relative to the value of sales, few supermarkets are likely to increase the risk of spoilage or invest much additional capital beyond normal replacement in order to save energy.

HOME FOOD PRESERVATION AND PREPARATION

As with the food marketing sector, electricity is the major energy source for preserving and preparing food in the home. In 1975, a combination of electric freezers, refrigerators, ranges, frying pans, coffee makers, toasters, and hot plates used all but 6 percent of the total energy consumed by this sector.

Both the type and quantity of energy used in the home for food preservation and preparation are closely associated with the type and form of food chosen by the consumer. A fresh product, for example, may require more in-home energy use in preparation than a precooked convenience food. Thus, precooking, processing, and packaging can greatly alter total energy savings.

Energy-efficient appliances. Consumers can cut energy use in food preservation by buying new energy-efficient freezers and refrigerators. However, their cost, which is 20–50 percent more than conventional units, can be a deterrent, especially for low- and middle-income groups.

Sales of such models won't be extensive until electrical operating costs increase to provide a 2- to 3-year payback period, as opposed to the 5 to 10 years it now takes to accumulate enough savings from operating costs to offset the initial cost.

The obstacle to widespread adoption of energy-saving home equipment is similar to that for supermarkets, processing plants, and farming practices—energy costs are still only a small portion of total costs. Food preservation and preparation in homes cost around $10 billion annually, while the value of food consumed is roughly $145 billion.

AWAY-FROM-HOME FOOD PRESERVATION AND PREPARATION

The half million food service establishments that prepare and serve food away from home in restaurants, cafeterias, coffee shops, institutions, and fast food outlets used 2.8 percent of the Nation's energy in 1974.

Energy use and cost vary greatly according to the nature of the establishment. For instance, a plush hotel-type restaurant uses four times as much energy as a fast food outlet.

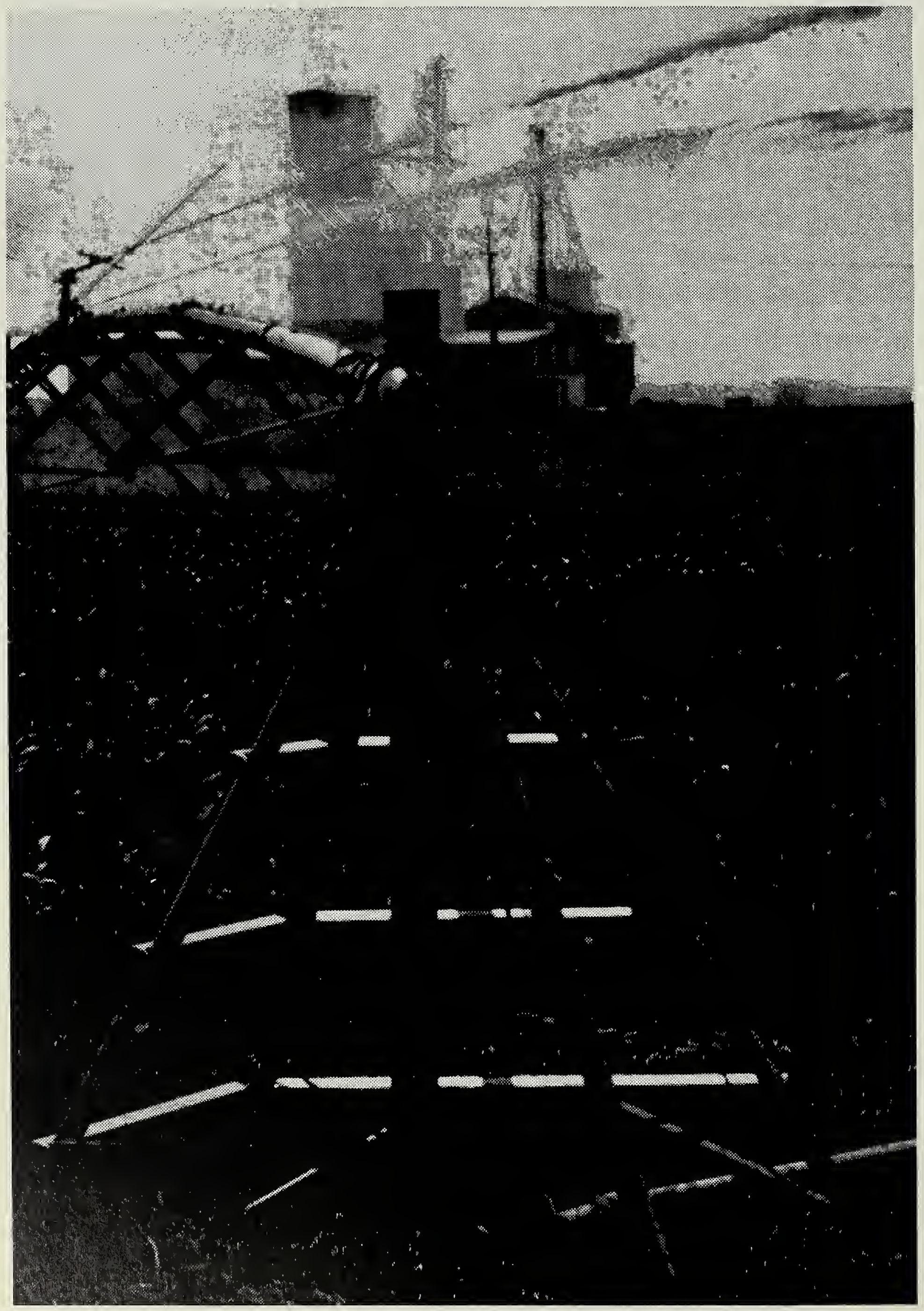
Conclusion. There are a number of opportunities for saving energy within all sectors of the food system. However, in order to improve total energy efficiency, all of the multiple characteristics and interactions of the different sectors must be considered.

For example, plans to conserve energy in food production must also consider the effect of this action in the processing, marketing, and consumption sectors.

[Based on the briefing paper, "Current Energy Use in the Food and Fiber System," by Otto Doering, Earle Gavett, Edward Rall, Robert Lundin, Tom Van Arsdall, and Pat Devlin, National Economic Analysis Division.]

Energy Savings in Irrigation: A Nationwide Effort

The importance of irrigation to U.S. agriculture would be hard to overestimate—about a tenth of all U.S. cropland is under irrigation, a quarter of the crop production is from irrigated acreage, and a fifth of the energy used on the farm goes to irrigation. Irrigation's energy intensity is proving to be a problem to farmers in all parts of the Nation. Farm Index *examines two aspects of the irrigation energy problem.*



SOUTHWEST

Southwest farmers who pump-irrigate are looking for ways to cut water use. They need to save both water and energy.

And it isn't going to be easy. Agriculture's dependence on water in recent years has increasd as irrigated acreage increased. With tightening water supplies, increasing electricity prices, and dwindling natural gas resources, water efficiency has to be watched ever more closely by irrigators.

Over the past few years, many farmers in the Southwest and elsewhere who had been using natural gas for irrigation pumps have switched to electric power. They're not switching because they want to; they're switching because natural gas is getting scarce and prices are going up. Turning to electricity, however, is not the sole answer. Electricity prices are going up, too, and the effects on farmers' profits can be disastrous.

An example. Take a typical farm covered by a recent ERS study of pump irrigation costs. Such a farm —932 acres in Arizona—showed profits (returns to land and management) of $31,000, with current electricity and fertilizer costs. (Anhydrous ammonia fertilizer prices, according to the study, are linked to natural gas prices. Fertilizer prices will rise 0.4 cent for every 1-cent increase in natural gas prices.)

Now, if electricity prices were to increase by a fourth, profits would drop $10,000. And if the price of

electricity continues to escalate, farmers will be forced to seek alternatives.

The answer is reduction. Since price increases for both natural gas and electricity are looked on as a foregone conclusion, one answer is to reduce water use. In the Arizona study, profits were increased by cutting water application per acre. Even though crop yields decreased slightly, the saving in pumping costs was greater than decreased revenues. Also, profits were increased by changing cropping patterns as the price of energy increased: Grain sorghum production was reduced.

In the long run, there are several ways farmers may cut water use and pumping costs and increase profits. As product markets permit, farmers may switch from low-value water-using crops to ones which yield a higher value per unit of water. Also, water saving irrigation equipment, such as sprinklers and drip irrigation systems, will become more profitable as the price of pumping increases.

In parts of Arizona and the arid Southwest, these water-saving systems are rapidly replacing surface irrigation techniques. As a last resort, pump irrigated farms may be taken out of production, or, in some parts of the Southwest, switched to dry land production.

[Based on the manuscript, "Impacts of Increasing Energy Scarcity in Irrigated Agriculture: An Empirical Study from the Arid Southwest," by Harry W. Ayer, Natural Resource Economics Division, and David J. Cormier, a student at the University of Arizona; with special material from Dwight Gadsby.]

NORTHEAST

In national irrigation statistics, the Northeast stands out in two ways: It has the least amount of irrigated land and probably the most expensive irrigation.

Specifically, only 2 percent of the Nation's irrigated land is in the Northeast, but most northeastern irrigators fuel their pumps with gasoline—one of the more costly energy sources.

Some 60 percent of the irrigated acreage in the Northeast gets water pumped by gasoline-powered engines. Another 23 percent receives water from diesel-fueled pumps; 11 percent from electric-powered ones; and 6 percent from pumps using liquid propane.

Gasoline most costly. Of these fuels, gasoline is by far the most expensive. It cost the Northeast farmer an average $26.28 an acre to pump ground water for the 1974 season. For the same quantity of water, liquid propane was next, at $23.74; diesel ranked third at $14.11; and electric power was the lowest priced pump fuel at $11.12 an acre. Thus, a shift from gasoline to electric power could cut costs by half—savings that many farmers are cashing in on.

Up to now, farmers apparently have been using two chief methods for determining when and how much to irrigate. They've been eyeballing the crops and the land, using their experience to determine whether more moisture is needed. And, they've used the squeeze test—picking up a handful of dirt and squeezing it to figure out how much moisture is in it.

Using western know-how. Both methods have served experienced irrigators well over the years, but today soil moisture monitoring devices—used for years by their western brethren—are being employed increasingly by easterners to gain maximum efficiency from irrigation water.

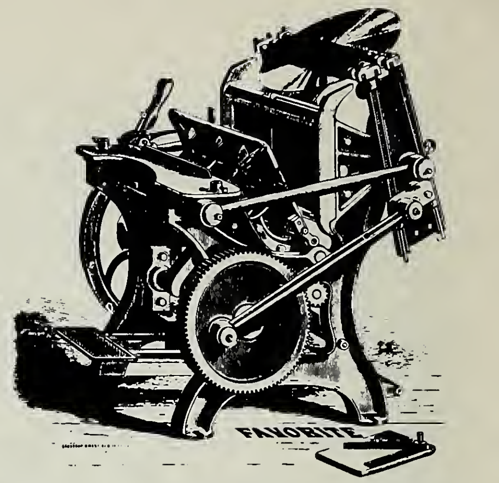
Northeast farmers are also studying their irrigation methods. For a given irrigation system, water saved in irrigation is roughly proportional to energy saved, so any measure that will conserve water will normally conserve energy.

Basic guidelines. Methods being adopted that offer improved irrigation efficiency include:

- Using larger pipes in sprinkler systems. This move can improve efficiency by cutting down on friction losses associated with smaller pipes. But larger pipes mean higher initial costs and added weight.
- Keeping irrigation machinery properly maintained and lubricated.
- Closely matching pumping plant and lift depth, as well as reducing ground water lift to a minimum.
- Leveling land serviced by gravity irrigation—about 9 percent of the Northeast irrigation uses this method—and lining canal ditches to reduce water losses.

[Based on the speech, "Conserving Irrigation Energy in the Northeast," by Dallas M. Lea, Natural Resource Economics Division, presented at the Northeast Agricultural Economics Council Meeting, Cornell University, June 29-July 1, 1977.]

Recent Publications



Single copies of the publications listed here are available free from The Farm Index, Economic Research Service, Rm. 1664-So., U.S. Department of Agriculture, Washington, D.C. 20250. However, publications indicated by (*) may be obtained only by writing to the experiment station or university. For addresses, see July and December issues of The Farm Index.

Interregional Movements of Eggs and Poultry, 1955-75. George B. Rogers and Ruth J. Irvin, Commodity Economics Division. Stat. Bul.-565.

The movement of poultry and poultry products in the markets within and between eight geographic regions are traced and discussed here. The authors analyze changing patterns of regional output, consumption, and interregional movements within the poultry and egg industry.

Economics of Rural Fire Protection in the Great Plains. Dan Childs, Gerald Doeksen, and Jack Frye, Economic Development Division. Agr. Inform. Bul.-407.

The authors present data and procedures to help local decisionmakers analyze alternative rural fire protection systems. Data are based on a 10-county area of northwest Oklahoma and an example is worked out, using the recommended procedure, for Ames, Oklahoma. Each copy of the report includes blank forms to help readers estimate the level of fire protection needed, capital and operating costs, and yearly costs.

Residential and Regional Distribution of Benefits Under the Allowance for Basic Living Expenses (ABLE) Welfare Reform Proposal. Thomas A. Carlin and Faye F. Christian, Economic Development Division; with Gary Hendricks, The Urban Institute. AER-374.

The Joint Economic Committee of the U.S. Congress proposed in 1974 that present Federal welfare programs—Aid to Families with Dependent Children and the Food Stamp Program—be replaced with a new program called Allowance for Basic Living Expenses (ABLE). This report compares the programs, and finds that ABLE would lead to a substantial increase in the numbei of people receiving this kind of Federal assistance.

Indices of Agricultural Production for Asia and Oceania, Average 1961-65 and Annual 1967-76. Asia Area, Foreign Demand and Competition Division. Stat. Bul.-573.

As part of a continuing assessment of the agricultural situation in other countries, ERS analysts have drawn tables of agricultural and food production, and population, for each of the countries in Asia and Oceania.

Africa and West Asia Agricultural Situation: Review of 1976 and Outlook for 1977. Developing Countries Program Area, Foreign Demand and Competition Division. FAER-138.

With record agricultural production in 1976, Africa's per capita food production improved by 1 percent, but still was lower than in the early 1970's. West Asia total farm output gained by 11 percent in that region's best ever agricultural year. This report explains the output situations in the individual countries.

Indices of Agricultural Production in Africa and the Near East, 1967-76. Developing Countries Program Area, Foreign Demand and Competition Division. Stat. Bul.-572.

Tables drawn by ERS analysts, with some financial assistance from the United States Agency for International Development, show the agricultural output of African and Near Eastern countries. Also included are tables on population, food production, and per capita agricultural production.

AO Means Outlook

Each month, *Agricultural Outlook* (AO) tackles the aggregate outlook for the food and fiber economy and picks it apart with the latest commodity-by-commodity analysis. It's USDA's official source on marketing costs and on food price and farm income forecasts.

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Economic Trends

[1] Ratio of index of prices received by farmers to index of prices paid, interest, taxes, and farm wage rates. [2] Average annual quantities of farm food products purchased by urban wage earner and clerical worker households (including those of single workers living alone) in 1959-61—estimated monthly. [3] Annual and quarterly data are on 50-State basis. [4] Annual rates seasonally adjusted second quarter. [5] Seasonally adjusted. [6] As of March 1, 1967. [7] As of Feb. 1.

Source: U.S. Dept. of Agriculture (Agricultural Prices, Foreign Agricultural Trade, and Farm Real Estate Market Developments); U.S. Dept. of Commerce (Current Industrial Reports, Business News Reports, Monthly Retail Trade Report and Survey of Current Business); and U.S. Dept. of Labor (The Labor Force and Wholesale and Consumer Price Index).

Item	Unit or Base Period	1967	1976 Year	1976 June	1977 April	1977 May	1977 June
Prices:							
Prices received by farmers	1967=100	—	186	195	191	194	184
Crops	1967=100	—	197	209	214	214	198
Livestock and products	1967=100	—	177	184	172	176	173
Prices paid, interest, taxes and wage rates	1967=100	—	192	193	204	204	203
Prices paid (living and production)	1967=100	—	188	189	198	200	198
Production items	1967=100	—	193	196	204	205	203
Ratio [1]	1967=100	—	97	101	94	95	91
Wholesale prices, all commodities	1967=100	—	182.9	183.2	194.3	195.2	194.4
Industrial commodities	1967=100	—	182.3	181.5	193.2	194.2	194.6
Farm products	1967=100	—	191.1	196.5	208.1	204.3	192.7
Processed foods and feeds	1967=100	—	178.0	181.8	188.5	192.0	190.1
Consumer price index, all items	1967=100	—	170.5	170.1	179.6	180.6	181.8
Food	1967=100	—	180.8	180.9	190.9	191.7	193.6
Farm Food Market Basket: [2]							
Retail cost	1967=100	—	1,895	1,901	1,935	1,924	1,938
Farm value	1967=100	—	749	762	750	755	744
Farm-retail spread	1967=100	—	1,146	1,139	1,185	1,169	1,194
Farmers' share of retail cost	Percent	—	40	40	39	39	38
Farm Income: [3]							
Volume of farm marketings	1967=100	—	121	108	99	99	113
Cash receipts from farm marketings	Million dollars	42,817	94,326	7,294	6,566	6,696	7,100
Crops	Million dollars	18,434	47,937	3,356	2,724	2,750	3,100
Livestock and products	Million dollars	24,383	46,389	3,938	3,842	3,946	4,000
Realized gross income [4]	Billion dollars	49.9	103.6	109.6	—	—	110.3
Farm production expenses [4]	Billion dollars	38.2	81.7	84.2	—	—	87.1
Realized net income [4]	Billion dollars	11.7	21.9	25.4	—	—	23.2
Agricultural Trade:							
Agricultural exports	Million dollars	6,380	22,996	1,824	2,209	2,199	1,882
Agricultural imports	Million dollars	4,452	10,992	1,020	1,404	1,257	1,240
Land Values:							
Average value per acre	Dollars	[6] 168	[7] 390	—	[7] 456	—	—
Total value of farm real estate	Billion dollars	[6] 182	[7] 396	—	[7] 460	—	—
Gross National Product: [4]	Billion dollars	796.3	1,706.5	1,691.9	—	—	1,869.0
Consumption	Billion dollars	490.4	1,094.0	1,078.5	—	—	1,194.0
Investment	Billion dollars	120.8	243.3	244.4	—	—	293.0
Government expenditures	Billion dollars	180.2	361.4	358.9	—	—	390.1
Net exports	Billion dollars	4.9	7.8	10.2	—	—	−8.1
Income and Spending: [5]							
Personal income, annual rate	Billion dollars	626.6	1,382.7	1,372.7	1,510.9	1,519.5	1,529.9
Total retail sales, monthly rate	Million dollars	26,151	54,324	53,983	59,465	59,247	59,233
Retail sales of food group, monthly rate	Million dollars	5,759	11,749	11,765	12,452	12,657	12,734
Employment and Wages: [5]							
Total civilian employment	Millions	74.4	87.5	87.5	90.0	90.4	90.7
Agricultural	Millions	3.8	3.3	3.3	3.3	3.4	3.3
Rate of unemployment	Percent	3.8	7.7	7.6	7.0	6.9	7.1
Workweek in manufacturing	Hours	40.6	40.0	40.2	40.3	40.4	40.5
Hourly earnings in manufacturing, unadjusted	Dollars	2.83	4.87	5.15	5.52	5.56	5.59
Industrial Production: [5]	1967=100	—	129.8	130.1	136.2	137.6	138.6
Manufacturers' Shipments and Inventories: [5]							
Total shipments, monthly rate	Million dollars	46,487	98,184	98,597	109,640	109,458	—
Total inventories, book value end of month	Million dollars	84,527	166,587	161,118	170,747	—	—
Total new orders, monthly rate	Million dollars	47,062	98,513	99,135	111,547	111,693	—

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